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The Spatial Variability of Potential Evapotranspiration at Mean Sea Level in England and Wales and the implications for mapping Median values of Potential Soil Moisture Deficit

by M Field

1. Introduction

The purpose of Land Classification is to provide information on the quality of agricultural land in a form which will be of value to land use planners, agricultural advisers, farmers and others involved in land use decisions. Land is classified according to the extent to which climate, site and soil impose long-term limitations on agricultural use.

In recent years two closely related systems, Agricultural Land Classification (1) and Land Use Capability Classification (2) have been used for assessing the quality of agricultural land in England and Wales. The revised system which is expected to be introduced shortly (3) updates the existing Agricultural Land Classification and incorporates the main features of Land Use Capability Classification.

It has been agreed that the climatic limitations in the revised Agricultural Land Classification scheme should be assessed in terms of median Accumulated Temperature and median maximum Potential Soil Moisture Deficit (PSMD). A map of median Accumulated Temperature has already been produced for the period 1961-80 (4). The base is 0 deg C and accumulations are made over the 6-monthly period Jan - June each year. Estimates of median max PSMD had already been made at single stations using an older calculation method for the period 1959-78 (5); however the parameter was not mapped after the completion of those calculations. A revised method of estimating PSMD based on the algorithms used in MORECS (6) has now been devised to produce values at single stations. However to progress from point values to a map is not necessarily straightforward. In mapping PSMD it is important to first have a good understanding of the spatial variability of Potential Evapotranspiration (PE) since PSMD is the cumulative difference between PE and rainfall. This paper discusses the spatial variability of mean annual PE at MSL over the period 1961-80.

PSMD normally begins to build-up in the Spring and maximum values are attained in late Summer/early Autumn. Thus one could argue that the period over which PE should be examined is March/April to September/October rather than the whole year and further that the median rather than the mean value should be found. However mean annual PE figures were readily available and so it was convenient to plot these initially. Since the results were so clear-cut there was no merit in re-plotting with a different PE parameter. It is also worth noting that the contribution to the annual PE from the winter months is small.

2. The Spatial Variability of mean annual PE at MSL

2.1 Estimating mean annual PE

Estimates of PE for grassland were made using Morecs algorithms (6) with data from the 'Complete Agromet Dataset' (7) which provides pseudo-complete records of rainfall, sunshine duration, maximum and minimum temperature, vapour pressure and windspeed for 94 stations in England and Wales over the period 1961-80. Values were reduced to MSL following Smith (8,9) who found that PE appeared to vary linearly with height. His correction factors are given in MAFF Technical Bulletin 35 (10) (see Table 1).

Decrease of PE with height

Table 1

	mm/100m		mm/100m		mm/100m		mm/100m
JAN	1.5	APR	3.5	JULY	3.0	OCT	1.5
FEB	2.0	MAY	3.5	AUG	2.5	NOV	1.0
MAR	3.0	JUNE	3.0	SEPT	2.0	DEC	1.0

The plotted data appear in Fig 1.

2.2 Remarks on Figure 1

The data do not show a smooth pattern of PE over the country. In fact variations over distances of 50 km are as great as those over distances of hundreds of km. One might have expected the map to show a gradual increase in PE from north to south possibly with an east/west gradient superimposed but this is not the case.

In the existing network the sites are in varied locations such as towns, the open countryside, seaside resorts, parks, a forest clearing and airfields. The map showing the actual pattern of PE cannot be 'decoded' from the 'noise' introduced by the many types of station. One can try to rationalise the network of stations by removing those which for example have a known coastal or urban influence. However this does not make the pattern any clearer and leaves large gaps in the network. By removing coastal sites for example virtually the whole of SW England and S and NW Wales are without data-cover.

To get some idea of the true variation of PE one would require

(a) many more stations

and (b) for these stations to be exposed under more uniform conditions.

3. Conclusion

The spatial variability of PE cannot be mapped satisfactorily given the inhomogeneous nature of the available climatological data. It is thus difficult to see a way of producing an accurate map of maximum PSMD.

References

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Any comments on this paper should be made directly to the author.

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M Field
Meteorological Office, Met O 8a
London Road
Bracknell
Berkshire
RG12 2SZ

FIG. 1

AVERAGE ANNUAL PE at MSL (1961 – 80)